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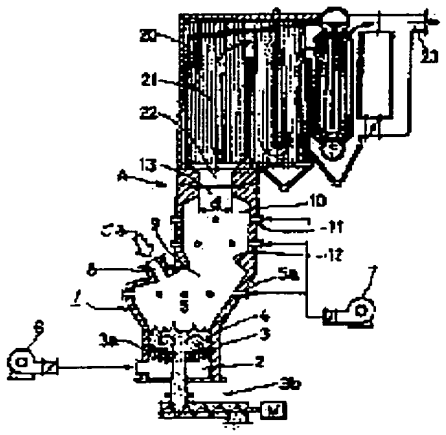
(54) FLUIDIZED BED TYPE REFUSE INCINERATOR WITH EXHAUST HEAT BOILER

(57)Abstract:
PURPOSE: To prevent the wear in the water tubes of an exhaust heat boiler caused by the flying sand of the sand layer section by burning in the combustion chamber unburned gases completely which are produced in the decomposition and gasification of refuses in the sand layer section and, at the same time, making compact the arrangement of the exhaust heat boiler.
CONSTITUTION: The temperature drop in a combustion chamber 5 due to the radiation of the water tubes of an exhaust heat boiler 20 is prevented by the arrangement that a throttling section 13 is provided at the inlet section of the exhaust heat boiler 20 the center of which is offset with respect to the center of the combustion chamber 5 between the combustion chamber 5 in the main body 1 of an incinerator and an exhaust heat boiler 20 and the exhaust heat boiler 20 is provided in the upper section, and the combustion chamber 5 is maintained at a high temperature and, at the same time, the sand flying from the sand layer section 4 can be prevented from reaching the water tubes in spite of the compactness of the boiler.



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FLUID BED TYPE REFUSE COMBUSTION FURNACE HAVING WASTE HEAT BOILER

The present invention relates to an improvement of a fluid bed type refuse combustion furnace having a waste heat boiler. More particularly, the present invention relates to a fluid bed type refuse combustion furnace having a waste heat boiler, in which unburned gas induced in decomposing and gasifying a refuse can be combusted surely and perfectly, and its installation area is narrow, and its size is compact, and a life of a water pipe of a waste heat boiler can be extended.

2. Description of the Related Art

As well known, as a refuse combustion facility for combusting a combustion material (hereafter, referred to as a refuse) such as a city refuse, a sludge, an industrial waste and the like, for example, a facility including a fluid bed type refuse combustion furnace (hereafter, referred to as a combustion furnace) has been mainly used. Usually, this further contains a heat collection facility for collecting a thermal energy generated by combusting a refuse.

[0003]

In the above-mentioned heat collecting facility, for example, large and middle combustion furnaces use a waste heat boiler. Thus, as a configuration of a refuse combustion facility, as shown in Fig. 4 of a diagrammatical configuration explanation view that is a first conventional example, a waste heat boiler 20 having a known configuration is placed through a first exhaust gas duct 31 from a furnace exhaust gas outlet 9 placed on an upper portion of a combustion furnace body 1.

[0004]

Also, an exhaust gas outlet 23 of the waste heat boiler 20 is linked to a dust collector 33 through a second exhaust gas duct 32 and linked to a chimney 36 through a third exhaust gas duct 34 constituted by an interposition of an induced draft fan 35.

[0005]

In detail, as shown in Figs. 5, 6, the combustion furnace body 1 includes a sand layer serving as a so-called fluid bed for fluidizing sand through first air supplied via a dispersion nozzle or a dispersion pipe placed in a lower portion of the combustion furnace body 1 and then thermally decomposing and firstly combusting a refuse supplied from a refuse

supply port 8 formed in the combustion furnace body 1 and thereby gasifying the refuse.

[0006]

Moreover, a combustion room 5 is installed above the sand layer. A plurality of second air blowing nozzles 11 penetrating the combustion furnace body 1 are opened in the combustion room 5. In short, the combustion furnace body 1 has the well known configuration so that the unburned gas induced by the above-mentioned thermal decomposition and gasification is secondarily combusted by second air blown from the second air blowing nozzles in this combustion room 5.

[0007]

As shown in a first embodiment, in the case of the refuse combustion facility having the so-called separation type configuration in which the combustion furnace body 1 and the waste heat boiler 20 are separately installed, it is the method that uses only the heat of the combustion exhaust gas exhausted from the combustion room 5 in the combustion furnace body 1 and can not use a radiant heat from an inner wall of the combustion furnace body 1. Thus, it has a problem to be solved, such as a necessity of a wide installation space, in

addition to a low heat collection efficiency.

[0008]

In view of the above mentioned circumstances, as shown in Fig. 5 of a perspective side section view that is a second conventional example, the combustion furnace having the waste heat boiler in which the combustion furnace body 1 and the waste heat boiler 20 are integrally formed into the single unit is proposed in which the waste heat boiler 20 is directly attached to an upper portion of the combustion room 5, namely, a top of the combustion furnace body 1.

[0009]

The combustion furnace having the waste heat boiler, which is the second conventional example, has a merit that the radiant heats from the sand layer and the inner wall of the combustion room 5 can be effectively used in addition to the heat generated by the combustion of the refuse, as can be well seen from Fig. 5, and the installation space can be made narrow as compared with the refuse combustion facility having the separation type configuration based on the first conventional example.

[0010]

However, this has the following problems to be solved. That is, a water pipe 21 of the waste heat boiler 20 is laid up to the lower portion of the combustion room 5 in the combustion furnace body 1. The endothermic action to the water pipe21 causes the drop in the temperature of the exhaust gas containing the unburned gas in the combustion room 5, which disturbs the perfect combustion of the unburned gas. In addition, the incoming of the sand from the sand layer of the fluid bed causes the abrasion of the water pipe 21. Thus, the combustion condition of the unburned gas is made worse to thereby shorten the life of the water pipe 21 of the waste heat boiler 20.

[0011]

So, in order to solve the above-mentioned problems of the worse combustion condition and the shorter life of the water pipe 21, a combustion furnace having a waste heat boiler that is integrally configured as shown in Fig. 6 of a side section view which is a third conventional example is proposed in which the center of the upper portion of the combustion room 5 in the combustion furnace body 1 is deviated from the center of the lower portion, and the waste heat boiler 20 is placed thereon,

treatment of slight hazardous substances contained in the combustion exhaust gas inside the combustion room, for example, the perfect combustion of CO gas and the decomposition of dioxin.

[0014]

In particular, in recent years, the increase in a refuse of a high calorie, such as plastic and the like, results in a large variation in a calorific value caused by the refuse combustion, on the basis of the presence or absence of the plastic. The amount of the induced gas is largely varied correspondingly to the variation in the calorific value of the refuse.

[0015]

In the case of the large variation in the induced gas amount as mentioned above, for example, if the induced gas amount becomes little, the radiant heat is absorbed, and the exhaust gas is cooled by the cooled wall surface of the combustion room. Thus, the greater temperature drop is brought about. Hence, the temperature of the combustion room is not sufficiently increased.

[0016]

On the other hand, if the induced gas

amount becomes greater, the combustion exhaust gas containing the unburned gas is sent in its original state into the waste heat boiler and cooled therein. Then, while the combustion exhaust gas is not perfectly combusted, it is exhausted from the furnace. Consequently, it is difficult to protect the exhaust of a large amount of hazardous slight substances such as CO gas, dioxin and the like.

[0017]

Moreover, as mentioned above, the sand of the sand layer is dispersed by the force of the first air blown from the dispersion nozzle and the dispersion pipe. However, it is impossible to sufficiently avoid a part of the dispersed sand to collide with the water pipe of the waste heat boiler. Thus, the water pipe is liable to be easily abraded. This results in an economic problem caused by the short life of the water pipe.

[0018]

Therefore, an object of the present invention is to provide a refuse combustion furnace having a waste heat boiler, in which since unburned gas is perfectly combusted inside a combustion room, an exhaust amount of hazardous slight substances, such as CO gas,

dioxin and the like, can be largely reduced, and its installation space is narrow, and its size is compact, and a water pipe of a waste heat boiler can be extended.

Summary of the Invention

The present invention is proposed in order to solve the above-mentioned problems. Therefore, a configuration of a combustion furnace having a waste heat boiler according to claim 1 of the present invention is characterized by including a combustion room in which a plurality of second air blowing nozzles penetrating a furnace body are opened on an inner side of a combustion furnace body above a fluid bed to thermally decompose and firstly combust a refuse supplied from a refuse supply port formed in the combustion furnace body through a first air supplied through a dispersion nozzle from a wind box in a lower portion of the combustion furnace body, and a waste heat boiler is installed above the combustion room, wherein an exhaust gas outlet whose center is deviated from a center of the combustion room is placed between the combustion room and the waste heat boiler, and a throttling unit is placed in a linkage portion to the waste heat boiler.

[0020]

Also, a configuration of a combustion furnace having a waste heat boiler according to claim 2 of the present invention is characterized by including a combustion room in which a plurality of second air blowing nozzles penetrating a furnace body are opened on an inner side of a combustion furnace body above a fluid bed to thermally decompose and firstly combust a refuse supplied from a refuse supply port formed in the combustion furnace body through a first air supplied through a dispersion nozzle from a wind box in a lower portion of the combustion furnace body, and a waste heat boiler is installed above the combustion room, wherein a throttling unit is placed between the combustion room and the waste heat boiler, and an upper portion of the combustion room is deviated from a center of the combustion room, and a re-combustion room in which a plurality of third air blowing nozzles are opened therein is installed.

[0021]

According to the combustion furnace having the waste heat boiler noted in claims 1, 2 of the present invention, in the waste heat boiler, its center is deviated from the center of

the combustion room, and the throttling unit is placed between the outlet of the combustion room and the inlet of the waste heat boiler. Thus, the excessively endothermic action is never done on the side of the waste heat boiler. The combustion room can sufficiently receive the radiant heat from the inner wall thereof. Hence, the inside of the combustion room can be always kept at the high temperature.

[0022]

Moreover, as mentioned above, the waste heat boiler is installed through the throttling unit deviated from the center of the combustion room. Thus, even if the sand is dispersed from the sand layer in the lower portion of the combustion furnace body, its main portion is sunk in the large combustion room, and the remaining dispersed sand also collides with the wall on the lower side of the throttling unit. Thus, the incoming of the sand to the water pipe of the waste heat boiler is avoided.

Brief Description of the Drawings

Fig. 1 is a schematic side section view of a middle combustion furnace having a waste heat boiler according to an embodiment of the present invention;

Fig. 2 is a schematic side section view of

a large combustion furnace having a waste heat boiler according to an embodiment of the present invention;

Fig. 3 is an A-portion enlargement view of Figs. 1, 2;

Fig. 4 is a diagrammatic configuration explanation view of a refuse combustion facility having a waste heat boiler that is a first conventional example;

Fig. 5 is a side section view perspectively showing a combustion furnace having a waste heat boiler that is a second conventional example; and

Fig. 6 is a side section view of a combustion furnace having a waste heat boiler that is a third conventional example.

Description of the Preferred Embodiment

An example of a combustion furnace having a waste heat boiler according to an embodiment of the present invention will be described below with reference to Figs. 1, 2 showing a schematic side section view thereof and Fig. 3 showing an A-portion enlargement view of Fig. 2. The same members as the conventional technique and the members having the same function as the conventional technique have the same symbols as the conventional

technique.

[0024]

A symbol 1 shown in Figs. 1, 2 denotes the combustion furnace body. This combustion furnace body 1 is configured such that a wind box 2 is formed in a lower portion thereof, and the first air supplied into the wind box 2 through a first air supply pipe from a first air fan 6 is blown into the combustion furnace body 1 from a dispersion nozzle 3a of a dispersion plate 3 placed above this wind box 2.

[0025]

A sand layer 4 serving as a fluid bed is supported by the dispersion plate 3. Above the sand layer 4, the combustion room 5 is placed for combusting the unburned gas through the second air blown into it from a plurality of second air blowing nozzles 5a circumferentially placed around an outer circumference. The second air is supplied into the second air blowing nozzle 5a through the second air supply pipe from a second air fan 7.

[0026]

Also, above the combustion room 5, the furnace exhaust gas outlet 9 is formed in one position deviated from a center of a diameter direction of the body, and the refuse supply port

8 into which the refuse is supplied is formed in the other deviated position (the side or the top plane), respectively.

[0027]

Fig. 1 shows an example of a middle combustion furnace having a waste heat boiler, and Fig. 2 shows an example of a large combustion furnace having a waste heat boiler. In the latter case of the combustion furnace having the waste heat boiler, a re-combustion room 10 is installed in the furnace exhaust gas outlet 9 in order to surely mix the exhaust gas and the combustion gas to perfectly combust the exhaust gas. In this re-combustion room 10, a protrusion 12 is formed on the inlet side, in order to agitate the flow of the exhaust gas flowing from the combustion room 5. In a wall of an upper portion of the protrusion 12, a plurality of third air blowing nozzles 11 are placed so as to penetrate the wall.

[0028]

A branch supply pipe branched from the second air supply pipe to supply the second air into the second air blowing nozzle 5a from the second air fan 7 is linked to those third air blowing nozzles 11. The air supplied through the branch supply pipe from the second air fan 7

is blown into the re-combustion room 10 from the third air blowing nozzles 11, as the third air.

[0029]

Above the re-combustion room 10, a waste heat boiler 20 is installed that has the known configuration in which it has an exhaust gas inlet 22 having an input diameter equal to a diameter of a throttling unit 13 of the outlet of the re-combustion room 10 and a plurality of water pipes 21.

[0030]

Although it is not shown, similarly to the conventional combustion furnace having a waste heat boiler, an exhaust gas outlet 23 of the waste heat boiler 20 is configured so as to be linked to a duct collector through a second exhaust gas duct and also linked to a chimney through a third exhaust gas duct constituted by an interposition of an induced fan.

[0031]

By the way, the linkage portion between the re-combustion room 10 and the waste heat boiler 20 is designed such that the interposition of an expansion joint 24 made of a SUS material between an end of a steel skin 10a for wrapping the re-combustion room 10 and an end of a steel

skin 20a for wrapping the waste heat boiler 20 enables the correspondence with the extension of the linkage portion and the protection of gas leakage.

[0032]

Also, a member downwardly extended in a center of a diameter direction of the dispersion plate 3 is an unburned substance discharger 3b for discharging the unburned substances, which can not be combusted, among the refuses supplied into the combustion furnace body 1 from the refuse supply port 8. This is configured similarly to the member installed in the lower portion of the conventional combustion furnace body 1, as can be seen from Figs. 1, 2.

[0033]

The operation of the combustion furnace having the waste heat boiler based on the above-mentioned configuration will be described below. The air supplied into the wind box 2 from the first air fan 6 is blown from the dispersion nozzle 3a placed on the dispersion plate 3, and it fluidizes the sand of the sand layer 4. The refuse supplied into the sand layer 4 is crushed by the fluidization of the sand, and gasified and combusted to thereby generate the exhaust gas containing a large

amount of unburned gas.

[0034]

The thus-generated exhaust gas is raised into the combustion room 5 above the sand layer 4. Here, it is secondarily combusted through the second air blown from the second air blowing nozzle 5a, due to the supply from the second air fan 7.

[0035]

By the way, in order to perfectly combust the unburned gas in the exhaust gas, it needs to sufficiently stay in the combustion furnace body 1, and this combustion room 5 needs to be successively kept at a high temperature. In particular, this is extremely important in largely reducing the exhaust of the hazardous slight substances, such as CO gas, dioxin and the like.

[0036]

In the embodiment shown in Fig. 1, the center of the exhaust gas inlet 22 of the waste heat boiler 20 is deviated from the center of the diameter direction of the combustion furnace body 1, and the throttling unit 13 is placed in this linkage portion, and the combustion room 5 having the sufficient capacity is installed below it. Thus, not only the stay time of the

unburned gas inside the combustion room 5 is made longer, but also the combustion room 5 is kept at a high temperature by receiving the combustion heat and the radiant heat from the inner wall of the combustion room 5 itself. Hence, the unburned gas, especially, the CO gas and the dioxin are perfectly combusted and decomposed.

[0037]

Also, the embodiment shown in Fig. 2 is configured such that the re-combustion room 10 is installed above the combustion room 5 so as to efficiently mix the exhaust gas and the combustion air in the large combustion furnace having the waste heat boiler, and the throttling unit 13 is placed in the linkage portion to the waste heat boiler 20 of the outlet thereof. Thus, not only the combustion room 5 but also the re-combustion room 10 can be kept at the high temperature.

[0038]

Also, at the inlet of the re-combustion room 10, the gas flow is effectively agitated by the deviation from the combustion room 5. As a result, the proper stay time can be reserved to thereby promote the mixture of the unburned gas and the second air blown from the second air

blowing nozzle 5a. Thus, this is extremely effective for the perfect combustion of the unburned gas.

[0039]

Next, as for the combustion exhaust gas combusted in the combustion room 5 as mentioned above, the gas flow is further agitated by the protrusion 12 formed on the inner plane of the inlet side and sent into the re-combustion room 10. In this re-combustion room 10, the unburned remaining exhaust gas contained in the combustion exhaust gas is perfectly combusted through the third air blown from the third air blowing nozzle 11.

[0040]

By the way, in the case of the large combustion furnace having the waste heat boiler, as compared with the middle combustion furnace having the waste heat boiler shown in Fig. 1, the employment of the re-combustion room 10 in which the diameter of the combustion room 5 can be made short is suitable for the perfect combustion of the exhaust gas containing the unburned gas, since the combustion air can be sufficiently supplied into the center of the re-combustion room 10.

[0041]

By the way, the re-combustion room 10 is also heated by the radiant heat of the combustion room 5 located at the lower portion, and the dispersion of the radiant heat of the inner wall of the re-combustion room 10 itself is protected by the throttling unit 13. On the other hand, the large endothermic action to the water pipe 21 of the waste heat boiler 20 is disturbed. Thus, the unburned gas is combusted further surely and perfectly.

[0042]

In particular, effectively, an inner dimension d of the throttling unit 13 installed in the linkage portion to the waste heat boiler 20 is set such that the gas flow velocity is 12 to 15 m/sec, and a length dimension in an upward and downward direction is set to 0.5 d to 1.5 d.

[0043]

Also, as shown in Fig. 3, the following mechanisms are ascertained to be proper. That is, the diameter is gradually thinned from the re-combustion room 10 to the throttling unit 13. On the other hand, the portion from this throttling unit 13 to the exhaust gas inlet 22 of the waste heat boiler 20 is gradually thickened by considering the abrasion caused by the dust and the deposition of the dust.

[0044]

On the other hand, in addition to the deviation from the center of the combustion room 5 in the combustion furnace body 1, the waste heat boiler 20 is installed above the combustion furnace body 1, through the throttling unit 13 to surely separate from the re-combustion room 10 or the combustion room 5. Thus, it becomes the compact apparatus as a whole. Even if the sand is dispersed from the sand layer 4 in the lower portion of the combustion furnace body 1, the dispersed sand is sunk in the combustion room 5 having the large capacity. The remainder collides with the wall on the lower side of the throttling unit 13. Consequently, the incoming of the sand to the water pipe 21 of the waste heat boiler 20 is avoided to effectively protect the abrasion of the water pipe 21. Thus, the life of the water pipe 21 can be largely extended as compared with the case of the waste heat boiler of the conventional combustion furnace having the waste heat boiler.

Advantageous Effects of the Invention

As detailed above, according to the combustion furnace having the waste heat boiler noted in claims 1, 2 of the present invention, in

the waste heat boiler, its center is deviated from the center of the combustion room, and it is installed above the combustion furnace body having the throttling unit at the inlet of the waste heat boiler and on the side of the combustion room. Thus, the waste heat boiler is compact in structure. The combustion room can receive the radiant heat from its inner wall. The combustion room or the re-combustion room is always kept at the high temperature. Consequently, the CO gas, the dioxin and the like can be perfectly combusted in the combustion room. The exhaust amount of the CO gas, the dioxin and the like from the combustion furnace can be surely reduced. Hence, this provides the remarkable effect to the improvement of the environmental pollution such as atmosphere pollution and the like.

[0046]

Moreover, the waste heat boiler is installed through the throttling unit deviated from the center of the combustion room in the combustion furnace body. Thus, even if the sand is dispersed from the sand layer below the combustion furnace body, the dispersed sand is sunk in the combustion room, and the remainder collides with the wall on the lower side of the

throttling unit. Consequently, the incoming of the sand to the water pipe of the waste heat boiler is avoided to thereby protect the abrasion of the water pipe of the waste heat boiler. Thus, it is possible to expect the very remarkable effect on the drop in the maintenance cost of the refuse combustion facility.

What is claimed is:

1. A fluid bed type refuse combustion furnace having a waste heat boiler, characterized by including a combustion room in which a plurality of second air blowing nozzles penetrating a furnace body are opened on an inner side of a combustion furnace body above a fluid bed to thermally decompose and firstly combust a refuse supplied from a refuse supply port formed in the combustion furnace body through a first air supplied through a dispersion nozzle from a wind box in a lower portion of the combustion furnace body, and a waste heat boiler is installed above the combustion room, wherein an exhaust gas outlet whose center is deviated from a center of the combustion room is placed between said combustion room and the waste heat boiler, and a throttling unit is placed in a linkage portion to the waste heat boiler.

2. A fluid bed type refuse combustion furnace having a waste heat boiler, characterized by including a combustion room in which a plurality of second air blowing nozzles penetrating a furnace body are opened on an inner side of a combustion furnace body above a fluid bed to thermally decompose and firstly

combust a refuse supplied from a refuse supply port formed in the combustion furnace body through a first air supplied through a dispersion nozzle from a wind box in a lower portion of the combustion furnace body, and a waste heat boiler is installed above the combustion room, wherein a throttling unit is placed between said combustion room and the waste heat boiler, and an upper portion of the combustion room is deviated from a center of the combustion room, and a re-combustion room in which a plurality of third air blowing nozzles are opened therein is installed.

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離するための絞部13を介して、焼却炉本体1の上部に廃熱ボイラ20が設けられているので、全体としてコンパクトな装置となり焼却炉本体1の下部の砂層部4から砂が飛散しても、飛散した砂は大きな容積の燃焼室5で沈降し、残りは絞部13の下側の壁に衝突する結果、廃熱ボイラ20の水管21までへの砂の飛来が阻止されるために水管21の磨耗が効果的に防止され、従来の廃熱ボイラ付焼却炉の廃熱ボイラの場合に比較して水管21の寿命を大幅に延長させることができるようになった。

【0045】

【発明の効果】以上詳述したように、本発明の請求項1と2に係る廃熱ボイラ付焼却炉によれば、廃熱ボイラは燃焼室の中心に対して中心が偏心し、かつ燃焼室側と廃熱ボイラの入口に絞部を備えた焼却炉本体の上部に設けられているので、廃熱ボイラはコンパクトな構造となり燃焼室は自身の内壁からの輻射熱を受けることができ、その燃焼室あるいは再燃焼室が常に高温度に保持される結果、燃焼室においてCOガスやダイオキシン類の完全燃焼が可能になり、焼却炉からCOガスやダイオキシン類の排出量を確実に減少し、大気汚染等の環境汚染の改善に対して多大な効果がある。

【0046】さらに、焼却炉本体の燃焼室の中心と偏心した絞部を介して廃熱ボイラが設けられているので、焼却炉本体の下部の砂層部から砂が飛散しても、飛散した砂は燃焼室で沈降し、残りも絞部の下側の壁に衝突する

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結果、廃熱ボイラの水管までへの砂の飛来が阻止されるために廃熱ボイラの水管の磨耗が防止される結果、ごみ焼却設備のメインテナンスコストの削減に対して極めて多大な効果を期待することができる。

【図面の簡単な説明】

【図1】本発明の実施例に係る中型の廃熱ボイラ付焼却炉の概略側面断面図である。

【図2】本発明の実施例に係る大型の廃熱ボイラ付焼却炉の概略側面断面図である。

【図3】図1および図2のA部拡大図である。

【図4】第1従来例になる廃熱ボイラ付のごみ焼却設備の模式的構成説明図である。

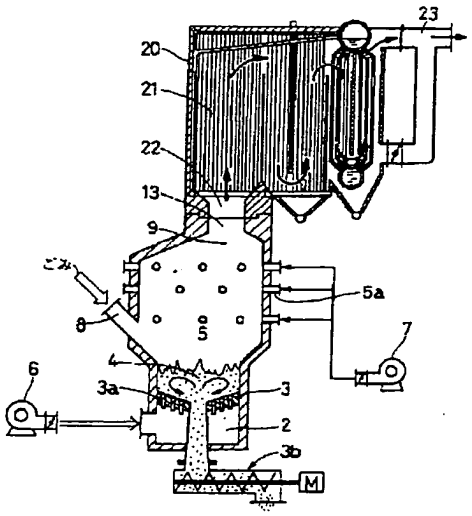
【図5】第2従来例になる廃熱ボイラ付焼却炉の斜視的に示す側面断面図である。

【図6】第3従来例になる廃熱ボイラ付焼却炉の側面断面図である。

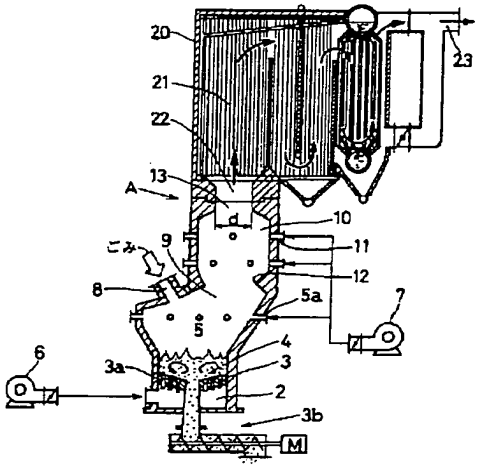
【符号の説明】

1…焼却炉本体、2…風箱、3…分散板、4…砂層部、5…燃焼室、5a…2次空気吹込ノズル、6…1次空気送風機、7…2次空気送風機、8…ごみ投入口、9…炉排ガス出口、10…再燃焼室、11…3次空気吹込ノズル、12…再燃焼室入口突起部、13…絞部、20…廃熱ボイラ、20a…廃熱ボイラの鉄皮、21…水管、22…ボイラ排ガス入口、23…ボイラ排ガス出口、d…絞部の内寸法、l…絞部の上下方向の長さ寸法。

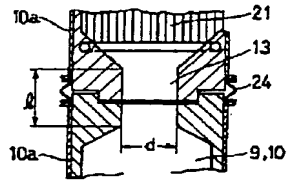
【図1】



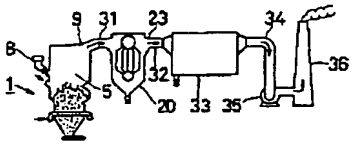
【図2】



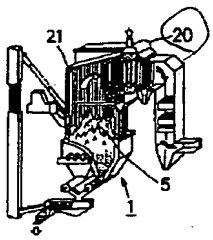
【図3】



【図4】



【図5】



【図6】